

John E. Madias, MD, FACC

Professor of Medicine
Chief, Cardiology Division
Elmhurst Hospital Center
79-01 Broadway
Elmhurst, New York 11373
E-mail: madiasj@nychhc.org

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Pulse Wave Reflection in Pulmonary Hypertension

In a recent *Journal* study, Nakayama et al. (1) showed that patients with chronic pulmonary thromboembolism (CPTE) had a higher pulmonary artery augmentation index and shorter inflection time than patients with primary pulmonary hypertension (PPH). Data were obtained on a large study population using fluid-filled catheters. Their findings—that increased and anticipated pulse wave reflection may help differentiate CPTE from PPH—are consistent with our recent reports, where we used high-fidelity catheters in a smaller population (2,3). One hypothesis is that the functional reflection site could be more proximal in CPTE than in PPH (1–4). Indeed, in PPH, pulmonary obstruction involves distal, medium-to-small-sized muscular arteries, whereas in CPTE, endothelialized residua narrow and stiffen proximal, major pulmonary arteries. However, we see a number of problems in the present study (1) with regard to the recording system, calculation of pressure reflection and discussion of the data.

First, signal distortions are unavoidable when using fluid-filled catheters, especially when pulsatile pressure characteristics are studied (5,6). As a result, the numerical data reported by Nakayama et al. require careful scrutiny owing to the previously documented pressure artifacts. The markedly negative values of the augmentation index (up to -80%) (1) correspond to pulmonary artery pressure shapes and reflection characteristics that have not been previously documented in PPH using high-fidelity catheters (7–10), and that we have never observed in our PPH patients (2,3). The pressure wave shape shown in Figure 1 of their study (1) is inconsistent with the prolonged time-to-peak pressure previously documented in PPH (8).

Second, identification of both the onset of the pressure pulse and the inflection point is not as easy as their study suggests. This may sound trivial but can result in large differences in time intervals and augmentation index. Previous studies have shown that the simultaneous analysis of the pulmonary artery pressure derivative with time significantly improves the identification of the inflection point (3,11). Numerous other factors may influence the numerical results, but unfortunately the investigators gave no information as to the inter- and intraobserver reproducibility of their measurements.

Furthermore, Murgo et al. (11) have shown that negative values of the augmentation index imply smaller or more diffuse reflections than other patterns. The results of the Nakayama et al. (1) study for PPH are thus inconsistent with the numerous reports demonstrating increased wave reflections in PPH (7–10).

In conclusion, the study of Nakayama et al. (1) is similar to previous studies demonstrating markedly increased wave reflection in CPTE (2–4) and suggesting that the timing and extent of wave reflection might be useful in the differential diagnosis of CPTE and PPH (2,3). The numerical values of the reflection indices calculated from fluid-filled catheters require careful scrutiny, whereas high-fidelity catheters must be preferred when attempting to obtain a reliable insight into pulmonary artery pathophysiology.

Denis Chemla, MD, PhD

EFCR Department
Hôpital de Bicêtre
78 rue du Général Leclerc
94 275 Le Kremlin-Bicêtre, France
E-mail: denis.chemla@bct.ap-hop-paris.fr

Vincent Castelain, MD**Gérald Simonneau, MD****Yves Lecarpentier, MD, PhD****Philippe Hervé, MD**

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